MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

EMT2036 – ENGINEERING MATHEMATICS 3

(All Sections / Groups)

11 AUGUST 2022

9.00 AM – 11.00 AM

(2 Hours)

INSTRUCTIONS TO STUDENTS:

1. This exam paper consists of **4 pages** (including cover page) with **4** Questions only.
2. Attempt **all** 4 questions. All questions carry equal marks and the distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided. Show all relevant steps to obtain maximum marks.
4. The required statistical book is provided.

Question 1 (25 marks)

(a) The student number in ten classes at a university is shown as below. Assuming that student number is normally distributed, construct a 95% confidence interval for the mean student number per class at this university. [12 marks]

20	18	25	30	10
15	45	20	10	16

(b) Given a solid $G=\{(x,y,z)|x^2+y^2\le 16, x\ge 0, y\ge 0, 0\le z\le 1\}$ and a function $f(x,y,z)=z$.

(i) Sketch the region of integration projected onto xy-plane. [4 marks]

(ii) Evaluate the triple integrals $\iiint_G f(x,y,z)dV$ using cylindrical coordinates. [9 marks]

Question 2 (25 marks)

(a) Use Green theorem to evaluate $\oint_C (6x-9y)dx-(xy-y^3)dy$ where C is the positively oriented closed curve with vertices $(0,0),(1,0),(1,2)$ and $(0,3)$. [11 marks]

(b) Use Divergence theorem to evaluate $\iint_\sigma \mathbf{F}\cdot\mathbf{n}\,dS$ where $\mathbf{F}=z\mathbf{i}+(z+y)\mathbf{j}+2x\mathbf{k}$ and σ is the portion of the paraboloid $z=6-x^2-y^2$ that lies above the plane $z=2$, oriented upwards.

[14 marks]

Continued...

Question 3 (25 marks)

(a) Determine whether $(1, 3, 2)$, $(2, 0, 1)$ and $(5, 2, 2)$ are linearly independent or dependent.

[4 marks]

(b) Given matrix $A = \begin{bmatrix} 1 & 3 & 3 \\ 0 & 4 & 5 \\ 0 & 0 & 1 \end{bmatrix}$.

(i) Determine the inverse of matrix A using elementary row operation.

[9 marks]

(ii) Solve $\left(\frac{1}{4}A\right)^{-1}$ using the results obtained from part (b-i). [4 marks]

(c) Solve the following system of linear equations by using Cramer's rule.

$$3x - 5y - 1 = 0$$
$$x + y = 2$$

[8 marks]

Continued...

Question 4 (25 marks)

(a) Find the inverse of the following matrix using the partitioning technique:

$$\begin{pmatrix} 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 4 & 0 & 0 \\ 0 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 2 & 3 \end{pmatrix}$$

[11 marks]

(b) Determine the eigenvalues for the matrix A.

$$A = \begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix}$$

[6 marks]

(c) Solve the following system of linear differential equations:

$$x_1'(t) = x_1(t) + 2x_2(t)$$
$$x_2'(t) = 4x_1(t) + 3x_2(t)$$

subject to $x_1(0) = 1$ and $x_2(0) = 0$. Given the matrix $\begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix}$ has eigenvalues -1 and 5 corresponding to eigenvectors $\begin{pmatrix} -1 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ respectively.

[8 marks]

End of questions.